

5-1-1935

Care of chronic arthritis from an orthopedic standpoint

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THE CARE OF CHRONIC ARTHRITIS FROM AN ORTHOPEDIC STANDPOINT

SENIOR THESIS

April 26, 1935

Douglas Dickson

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THE CARE OF CHRONIC ARTHRITIS FROM
AN ORTHOPEDIC STANDPOINT

In this thesis no attempt will be made to discuss chronic tuberculous arthritis, septic arthritis, chronic luetic arthritis or those forms of arthritis the specific cause of which is represented by some single chemical factor. There has been an attempt to limit the discussion to those forms of arthritis known as atrophic and hypertrophic arthritis. To make this limitation even more clear the various synonyms for these two forms of arthritis will be discussed thoroughly later on in this thesis.

The most important factor in the care of chronic arthritis is the prevention of deformity. The prophylactic measures concerned will be handled in detail. To cover the field completely mention will be made to the surgery of chronic arthritis. The arthritics to whom this special type of surgery is applicable are the derelicts. The surgical procedures available will be considered from a general point of view. Chronic arthritis is a very ancient disease attacking both man and animal. Pemberton and Osgood (No. 46) refer to Moody in estimating the period involved to be quite beyond our comprehension, perhaps six hundred million years. The pathology found in some of these remains is very similar to that found by necropsy on the spine of human beings suffering with chronic arthritis. In the museum of the University of Kansas is the skeleton of a prehistoric swimming reptile showing evidence of chronic arthritis in the metacarpal phalangeal joints. This is the first known example of multiple arthritis in fossil veretebrae. (No. 46)

CLASSIFICATION

A term which is quite enlightening as to the end results of both types of arthritis has been advanced by Virchow under the name of arthritis deformans, (No. 46) but at the same time it is quite confusing to the student of this disease. All types of arthritis are potentially deforming and, therefore, this term can quite adequately be applied to all types of arthritis. At the present time two different types are seen, possibly with similar etiology, different pathology, different age and sex incidence, and both deforming, but not in the same sense.

Pemberton and Osgood (No. 46) have given a complete resume of the classification of arthritis. They give the many synonyms used by various authors throughout the literature as they have dealt with this subject. The following two charts are taken from their book. (No. 46)

Arranged under headings of atrophic and hypertrophic type

AUTHORS	ATROPHIC	HYPERTROPIC
Kings (1857)	Polyarticular type	Monoarticular type
Charcot (1881)	Rapid evolution. Age incidence 16 to 30. Little new formation of bone.	Gradual evolution. Age incidence 40-60. Hyperostosis. Heberden's nodes. Malum coxae senilis.
Garrod (1890)	Rheumatoid arthritis: (a) Acute (b) Chronic. Still's disease	Osteoarthritis.
Bannatyne (1896)	Rheumatoid arthritis: early	Rheumatoid arthritis: late.
Goldthwait (1904)	(a) Infectious arthritis (b) Atrophic arthritis.	Hypertrophic arthritis.
Nathan (1906)	(a) Acute infectious arthritis (inflammatory). (b) Insidious autotoxic arthritis (trophic).	Insidious progressive osteoarthritis (trophic), senile arthritis, Heberden's nodes, malum coxae senilis. Tabes dorsalis, syringomelia.
Pribram (1907)	(a) Chronic pseudo-rheumatism. (b) Chronic secondary articular rheumatism. (c) Rheumatoid arthritis.	Osteoarthritis deformans.
Hoffa and Wollenberg (1908)	(a) Secondary chronic articular rheumatism. (b) Primary progressive polyarthritis. "Arthritis destruens."	Osteoarthritis deformans.
Llewellyn Jones and other British authors (1908)	Rheumatoid arthritis: (a) Acute. (b) Subacute	Osteoarthritis.
Nichols and Richardson (1909)	Proliferating or ankylosing arthritis	Degenerative or non-ankylosing arthritis.
Osler and McCrae	(a) Lesions principally in synovial membrane.	Hypertrophy and overgrowth of bone.

Ely (1914)	Type I	Type II
	Primary proliferation of synovial membrane and marrow. Secondary atrophy of cartilage and bone.	Primary inflammation of synovial membrane and degeneration of synovial membrane and marrow. Secondary hypertrophy of bone and cartilage.
Fisher (1923)	Type II (Synovial)	Type I (Chondro-osseous)
	Primary synovial membrane invasion. Secondary cartilage and bone invasion.	Primary cartilage and bone invasion. Secondary synovial membrane invasion.

AUTHORS

ATROPHIC

HYPERTROPHIC

Type III (Mixed)
Simultaneous invasion syovial membrane, cartilage,
and bone.

Various Authors

Spondylitis Deformans

"Poker back." Spondylose
rhizomelique. Strumpell-
Marie type.

Osteoarthritis. Hyper-
trophic arthritis, von
Bechterew type.

ATROPHIC ARTHRITIS

HYPERTROPIC ARTHRITIS

Common synonymous
terms employed in
other Classifica-
tions

Rheumatoid Arthritis.
Proliferative or Ankylosing
Arthritis.
Arthritis Deformans.
Poker Back, Spondylitis
Rhizomelique, Strumpell-
Marie Type.
Still's Disease (Children)

Osteoarthritis.
Degenerative or Non-
Ankylosing Arthritis.
Osteoarthritis of the Spine
von Bechterew's Syndrome.
Malum Coxae Senilis.

Age
Incidence
Body Type

From infancy to middle life.	From middle life to death.
Somewhat more common in slen- der ptotic women and men.	Somewhat more common in stocky well-nourished men and women.
Acute to insidious.	Subacute to ignorance of presence.

Symptoms and Signs

General health usually not robust, fatigued easily. Pain and disability often pro- nounced. Joint swellings and muscle atrophy to be observed.	General health usually less disturbed. Pain and disability often slight. Joint swellings and muscle atrophy less noticeable.
---	---

Early

No apparent cartilage or bone changes. General increased density of soft parts. Diminished density of bone, Atrophy--No "lipping." Narrowed articular space, subluxations--ankylosis.	Slight "lipping" of arti- cular margins. No general increased dens- ity of soft parts. Less diminished density of bone (unless long nonuse). Articular space irregular, hyperostoses. No ankylosis.
--	--

Roentgenological
Appearances.
Late

Early

Early proliferation of syno- vial membrane--"pannus." Usually small round cell in- filtration.	Early fibrillation of arti- cular cartilage. No general proliferation of synovial membrane. No small round cell infiltration. Chondroosseous hypertrophy of articular margins.
---	--

ATROPHIC ARTHRITIS

HYPERTROPHIC ARTHRITIS

Morbid Histology.	Epithelioid Nests. Late destructive and atrophic processes in cartilage and bone. Fibrous or bony ankylosis.	Late eburnation, deformation, and hypertrophy of articular bone-ends. Cyst-like cavities in cancellous bone near articular surface. Joint mice common--No true bony ankylosis.
Late		

Pemberton and Osgood (No. 46) are of the opinion that both types of disease may occur at the same time, and this may account for the mixed type that Fisher described. (No. 46) The two diseases occurring in the same individual are rare, as the age incidence, body type, and exciting causes are different for the two diseases. The confusion encountered in going through the literature is considerable. Since there is no common etiological basis for the disease, it is impractical to consider nomenclature from this angle. There are, however, two consistent pathological findings among the many differences of opinion concerning minor pathological points, and that is the universal presence of atrophic and hypertrophic changes in the two types of disease.

Repeated exposure to dampness, especially chilling dampness, seems to be a definite predisposing factor to atrophic arthritis. Occupation seems to be a negligible factor unless it is under the above described conditions. In the atrophic type trauma is looked upon in the same light. According to Pemberton and Osgood (No. 46) arthritis is less commonly seen in the aortic circles and near the equator; it is a disease found mostly in the temperate zones. On the other hand occupation seems to play a big part in the onset of hypertrophic arthritis. The repeated trauma to joints in certain occupations seems to result most often in this type of arthritis. Where the disease is already present repeated trauma, strain, malalignment of joints increase the severity of the local lesion. This latter fact was even noticed as far back as the time of Hippocrates, (No. 46) reports even at that time by Hippocrates show the relation between sciatica, backpain,

lameness, and stiffness of the hip joints in horseback riders. Hypertrophic arthritis likewise is seen in most all climates except the aortic circles and equator. Hygienic living conditions seem to alter the course somewhat, but it is not a disease that is peculiar to the poor or rich.

Injury and overuse nearly always result in an acute "flare up" of hypertrophic arthritis, while cautious exercise often helps the subacute or chronic atrophic arthritic patient. Atrophic arthritis is seen more commonly in poorly nourished women than in men. The disease begins most frequently early in life. Pemberton and Osgood (No. 46) mention several cases studied by Still that were seen in children associated with splenic and lymphatic glandular enlargements and is now known as Still's disease.

Hypertrophic arthritis seems to have no specificity for sex. Women at or near the menopause are prone to it, but athletes and those exposed to occupational trauma are as well. Age incidence varies considerably, but unless trauma is a factor it is rarely seen before forty years of age.

Two types of people have been described by the anthropologist, the slender visceroptotic or carnivorous type, and the other the stocky well-nourished, or herbivorous type. Atrophic arthritis seems more commonly to attack the slender visceroptotic carnivorous type and hypertrophic arthritis seems to be more common in the stocky herbivorous type.

PATHOLOGY

Atrophic arthritis--The earliest evidence seen is thickening

of synovial membrane. Clinically this is preceded by one or several joint effusions. The synovium shows marked congestion which pits when pressed. The cartilage loses its normal white, glistening color and assumes a rough, dull, reddened appearance. Red cells, fibrin, and white cells are seen on the exudate. At the same time there is a hypertrophy of the perichondrium or articular cartilage and also increase of the connective tissue in the epiphyseal marrow.

Proliferation of granulation tissue over the synovium soon produces a pannus-like layer, seen especially in immobilized joints, but is soon absorbed after return of motion. If this pannus remains too long, it soon results in absorption of the cartilage. The destruction of cartilage appears in the periphery of the joint in contradistinction to the center of the articular surface in the hypertrophic type. The above described hypertrophic perichondrium may later turn into cartilage and even have bone in some instances. Cartilage destruction and production may occur at the same time. A process very similar is carried on in the endostium which may lead later to the production of bone under the articular surface.

(Nichols and Richardson No. 47)

The synovial membrane and joint capsule become thickened and the pannus-like membrane soon degenerates. In some instances the cartilage does not degenerate and becomes united at the periphery with joint surfaces, forming fibrous adhesions, and often the pannus extends down through the articular surface to bone. This latter process is regarded as the most severe of the two complications.

Papillary projections may extend from the joint cavity or pannus. According to Nicholas and Richardson (No. 47) the origin of these projections may be from the pannus, synovial membrane, or from connective tissue on the wall of the joint cavity. These projecting villi are composed of epithelial cells, granulation tissue and newly formed blood vessels. They often change into dense fibrous tissue and in some instances become ossified, and as a result of trauma may become separated to form loose bodies.

Atrophic arthritis of the spine has been regarded by some to be a distinct disease entity. Pathologically the process is very similar to those changes seen elsewhere in the body. The main factor here is the ankylosis of the intervertebral articulations and the ossification of the ligaments of the spine. In many instances this produces a poker-like-spine. Quite often the lamina and costovertebral articulations are included in this ankylosis. In many instances after complete bony fusion has taken place the intervertebral discs entirely disappear. The disease inside the joint results in irritation to extraarticular structures causing spasm in surrounding muscles. This spasm in turn may result in subluxation of the joints. Limitation of motion is more and more increased and finally ankylosis results. According to Kuhns (No. 60) there are three types of ankylosis. If the synovial pannus predominates the ankylosis is cartilaginous. Less often, however, is when two bones become united, this latter type of ankylosis is most frequently encountered in the phalanges.

Another early change seen in atrophic arthritis is muscular atrophy. At times it is general but most often is seen in those joints involved in

the arthritic process. Jones (No. 60) has shown that there are indistinct striae, and also areas of fatty degeneration. There are many theories as to the cause of muscular atrophy. Probably the best explanation is based on atrophy of disuse. Kuhns (No. 60)

The skin changes over the joints of atrophic arthritic patients are usually quite striking. The skin shows hypotrichosis, tautness, thinness, and smoothness. According to Kuhn (No. 60) histological examination of such skin shows atrophy of sebaceous glands and hair follicles with an increase in fibrous tissue and hyalin degeneration of the arteries of deeper layers. There have been many authorities who have attempted to explain the general constitutional involvement of this disease on pathological changes found in various organs, but so far they have not been able to demonstrate consistent pathological findings of any consequence.

Hypertrophic arthritis (Pathology)--Hypertrophic arthritis is seen most frequently in the obese individual past middle age. The characteristic finding is a degeneration of articular surface with chondro-osseous hyperplasia of the margins of the joint; according to Nichols and Richardson. (No. 47) the degeneration is the earliest change. The color of the articular surface is quite characteristic. It changes from a glistening white surface to a yellowish dull tinge as a result of being stained with extravasated blood pigment. As noted above, the first change in the hypertrophic arthritis is in the center of the cartilage in contrast to the peripheral hyperplastic change in the atrophic arthritis. This degenerative process occurs at right angles to the articular surface. The cartilaginous surface assumes a granular appearance where both macroscopic and microscopic

threads can be seen. As the matrix is lost the cells are set free in to the synovial fluid. This degeneration usually occurs in patchy areas leaving small pits over the surface. According to Boyd (No. 21) these patchy, pitted areas are due to exposure of the Haversian canals. Simultaneously with this degenerative process is a proliferating process taking place on the articular surface of the adjacent part, which in many cases fits the small pits on the articular surface. There is also a proliferating process occurring at the same time on the perichondrium within the joint capsule. According to Boyd (No. 21) this change is a result of the better nutrition about the periphery of the articular surface. The cartilage that is formed here may later become ossified. According to Kuhns (No. 60) this cartilage that is heaped up on the margin of the perichondrium may become invaded by the osteoclasts and the epiphyseal bone marrow be changed to bone.

Boyd (No. 21) advocates that the bone under the cartilage that has become degenerated becomes more dense, possibly as a compensatory factor. Similar to atrophic arthritis, here also the marrow spaces become invaded by connective tissue and later osteoclasts may form new trabeculae of bone. The thickening of the underlying bone does not occur until after the cartilage has become perforated. This thickened layer of bone soon becomes highly polished as a result of joint friction. This is termed by Boyd (No. 21) as eburnation.

The bone marrow immediately under this thickened trabeculae of bone contains considerable connective tissue and also fat. The bone immediately underneath is less dense. This condition shows up in the

roentogram as an increase in the bone shadow. This change in the bony structure makes it less resistant to strain and may later show up in distortions of the weight-bearing line.

As a rule there is no associated joint capsule thickening. Projection of the papillary masses into the joint cavity is subject to trauma and may often result in effusions into the synovial fluid and also into bursa surrounding the joint. These papillary masses are composed of connective tissue. Oftentimes fat may be deposited in them in which case they are called lipoma aborescens. In some instances they may be converted into cartilage or bone. Due to constant trauma they may be pulled off resulting in loose bodies.

The ligaments of the joints in some instances undergo degeneration. This is especially true in the knee. Oftentimes the marginal osteophytes may result in displacement of tendons. Gradually for some unknown reason the ligaments simply melt away, as well as neighboring tendons. The latter is most often seen with reference to the biceps as it passes through the shoulder joint.

Subluxation is not nearly so common here as in the atrophic type of disease. Moderate atrophy from disuse may be noticed but not anything like the atrophy seen in a typical case of atrophic arthritis. Ankylosis practically never occurs, but bony and cartilaginous proliferation may be so extensive that motion is very much restricted. Throughout the body in general no lesions in other organs have been associated with hypertrophic arthritis. Arteriosclerosis occasionally is associated but with no convincing frequency.

POSTURE AND BODY MECHANICS

The prevalence of the two types of arthritis, atrophic and hypertrophic, in the carnivorous and herbivorous types of individual has already been mentioned in this thesis. It is a very common thing for arthritides to develop faulty posture, visceroptosis and eventually a dysfunction of the entire gastro-intestinal tract. When this has happened, of course, there is a vicious cycle set up and the above factors become exciting factors.

Heredity as a factor in arthritis might be mentioned at this time. It is true that body types are inherited. The tall, slender, carnivorous type of individual is more prone to develop faulty posture, visceroptosis, and dysfunction of the gastro-intestinal tract. In this manner heredity may be a factor in the creation of a vicious cycle. In the individual who has developed a short type of build, his joints are under the burden of carrying excess weight. This type of trauma alone according to Pemberton and Osgood (No. 46) has produced articular lesions closely simulating if not identical with the generalized disease of hypertrophic arthritis.

Extreme degrees of faulty posture are more often associated with atrophic arthritis, and the importance for their correction is far greater in the atrophic type than hypertrophic type of disease. This is brought out by the fact that atrophic arthritis is more commonly seen in the slender, poorly nourished individual where faulty posture is more pronounced.

In the care of faulty body mechanics there are several objects to be kept in mind. First, the correction of attitudinal faults and malalign-

ment. Second, is development of an unconscious sense of normal posture. In doing so there must be corrective exercises applied in order to strengthen musculature of the trunk to maintain such position. Pemberton and Osgood (No. 46) quote Sherrington as saying, "Reflex maintenance and adjustment of posture is a chief portion of reflex work of the proprioceptive system, just as sensation of perception of posture is a chief portion of the psychological output of the system."

There must be developed a conscious control of the muscles maintaining good posture to strengthen them so that in due time they can combat the forces of gravity and hold the individual in a correct posture without bringing on fatigue. This has been shown to be not only a theoretical possibility but has been demonstrated by Cook (No. 46) according to Pemberton and Osgood (No. 46). Cook demonstrated on Yale students who after returning to school after a summer vacation without special exercises, returned in the fall with approximately the same posture rating as they had had at the end of the previous school term.

Most faulty postures are associated with fatigue, or it may be the fatigue is responsible for the faulty posture. Either being the case rest is indicated. If the patient is resting, it is much easier to put weight on the undernourished individual with atrophic arthritis and easier to take weight off the overweight individual with hypertrophic arthritis. In addition to relieving the fatigue by rest, the recumency is a potent factor in relieving distortions along the spine due to the pull of gravity on a skeletal system supported by fatigued musculature. Much of the correction of malalignment is aided by stretching of capsules, ligaments, and

muscles, but in some instances force must be used as corrective agent.

According to Pemberton and Osgood (No. 46) at the onset of the treatment of atrophic arthritis the patient should be put in recumbency for at least a month. At the onset of this treatment the patient should be subjected to certain positions for a short duration of time and increased at intervals. The purpose of the positions is to diminish lumbar lordosis and thoracic kyphosis and to increase the size of the chest cavity to allow more room for expansion of the lungs and excursion of the diaphragm which tends to increase the circulation in general. Two positions which help in the accomplishment of the above are hyperextension and prone position. This is attained by placing a small hard pillow under the patient in a recumbent position usually about the level of the sixth or seventh thoracic spine, never in the lumbar region as it defeats the purpose. Hyperextension should be brought on gradually. In those cases where the need for correction is extreme and where some muscle spasm is associated as well as rigidity the indication for a corrective jacket is both time saving and, from the standpoint of results, desirable. By means of an adjustable table a plaster jacket may be applied when the patient is in recumbency in that position where pain from correction is not too great. At times one, two, and even three corrective jackets may have to be applied. During the early part of the treatment the jacket is removed for massage and exercise. This type of correction is not applied as it should be if it adds to the discomfort of the disease. This corrective plaster jacket if made very thin may be used for the model of lighter leather or celluloid jacket.

In some instances the patient may be seen in such severe deformity or the bony landmarks so prominent that the use of a corrective jacket

would result in bed sores. According to Pemberton and Osgood (No. 46) these patients are best cared for by placing them in an adjustable Bradford frame.

In those cases confined to bed in the recumbent position the patient becomes very uneasy and a change of position is very essential. Pemberton and Osgood (No. 46) describe a position that does not alter the results already accomplished and at the same time gives the patient a change. The patient is placed in the prone position with a pillow under the chest and abdomen. The thickest part of the pillow is placed down towards the pubis and tapering towards the chest. A thin pillow adds much to their comfort if placed under the shoulders. This position though not as effective as the above described hyperextended position is very good for the purpose intended. Exercise is an effective means in increasing the strength of the muscles involved in maintenance of good posture and to increase the capacity of the thoracic cavity. By increasing the tone and excursion of the muscles of respiration one gets a two-fold result, the respiratory and circulatory mechanics are both enhanced by increasing ventilation of the lungs, lifting mechanical pressure in crowding of the heart, and by better excursion of the diaphragm the organs of the abdominal cavity are given displacement and then are given an effective internal massage. In Pemberton and Osgood (No. 46) are given the many exercises in detail that may be used in procuring the end results stated above.

The corrective measures already described are most useful in the care of atrophic types of arthritis. However, there are many instances as the lumbar lordosis and pendulous abdomen of the hypertrophic arthritic pat-

ient that needs attention. These patients are not bedridden usually and are helped much by corrective jackets and other methods of support. Certain prescribed exercises may help considerably by developing a better set of musculature.

In the case of hypertrophic arthritis the joints themselves in many instances need rest. Overuse and strain may cause traumatic irritation which aggravates this condition. Many times the joint is "limbered up" and the following day the joint is more stiff than ever.

PREVENTION OF DEFORMITY

In the care of the chronic arthritic the doctor is prone to look at the problem of prevention of further extension of the local lesion and overlook a bigger factor than that of deformity. The prevention of further extension of the local lesion is very important, but equally as important is to not allow the patient to assume a position most comfortable to him in an effort to relieve pain. This is especially true during the active stage of the disease. Too often the patient is allowed while in bed to have the back elevated and the thighs held in a flexed position by being blocked up with pillows.

Traumatic lesions (No. 7) which at first are very insignificant often lead to considerable trouble later. As for example, the shoulder may be traumatized directly or the gluteal and lumbar muscles may be traumatized by foot strain and before the primary injury subsides, the elements capable of producing arthritis come in to play, causing in the traumatized tissues a low grade chronic inflammatory reaction with resultant deposits of scar tissue and in some cases calcium salts. This problem is of importance to

the doctor in two primary ways. First, because simple injury will not respond to therapy and second, because this bursitis or myofascitis may even result in arthritic intra-articular involvement.

Many patients suffering from arthritis have weak feet, although reducing this strain does not always cure the arthritis, it does relieve the pain and fatigue and this alone would help fight the disease much better.

The care of any deformity as coxa vara, genu valgus, and flat feet in many cases will aid the arthritic problem. Elmslie (No. 22) reports a case of osteo-arthritis of the knee which had given trouble for twenty years and which was relieved completely by removal of a damaged semilunar cartilage.

Spondylitis deformans, that form of atrophic arthritis described by Marie-Strumpell, is of primary importance to the orthopedic man. The early signs are definite limitation of motion of the spinal column and limited chest expansion. Failure to recognize these early symptoms may result in bad deformity which is easily avoided even though the progress of the disease is difficult to check. If the intervertebral discs and ligaments are to ossify and ankylose, then it should be seen that they ankylose in a position optimum for function. It is often possible even after marked degrees of stiffening to increase greatly the capacity of the thoracic cage by means of forced positions, braces, exercises, and corrective jackets. Some more prophylactic measures are, if a patient is confined to bed and if the patient is on a soft, sagging mattress, the spine is most apt to become definitely curved from lying in one position. Under these circumstances there is every possibility that the curvature may become fixed. If the pressure of bed clothes causes pain

over inflamed joints a cradle will in all probability be used, but the same pressure without pain is quite apt to cause a foot drop which may be overlooked until a fixed equinus has resulted. In order to avoid the pressure of the bed clothes on the feet the patient will often externally rotate the thigh and flex the leg on the thigh hence the value of traction, foot piece, a basket splint, or posterior molded splint. These factors will be discussed in detail later.

Since the time of the World War, the care of injuries and inflammatory diseases about the joints has changed. It has been found that the best results are obtained if the joint is put to rest. At one time it was thought disease about a joint required immediate and continued motion to prevent loss of function. Even if ankylosis is to occur it is much better to immobilize the joint so it will be fixed in a position for better function than the deformed position which it is bound to assume if allowed to choose its own position at rest.

Early in the disease one is mainly concerned with the prevention and maintenance of joint mobility. The muscle spasm present in the actively inflamed joint is the cause for deformity. Scar tissue sooner or later fixes the joints in the deformed position. The scar tissue is met with in the capsule tendon, ligaments, and even intra-articular. General or systemic measures are applied as a part of constitutional means for promoting the increase of circulation and metabolism. Local measures are applied to relieve pain, remove exudates, prevent atrophy, stiffness, and weakness. Heat is a potent agency in promoting circulation and metabolism. Changes in body temperature result in accelerated pulse rate and increase in circulatory rate and general

vasodilatation. Metabolism always shows a definite increase with relation to body temperature. The use of heat locally is through the means of many measures, hot compresses, hot poultice, electric heating pads are all popular pain relieving devices. The infra red lamp and luminous heat generators have replaced in many instances the dry baking apparatus previously used. The patient should be exposed for half an hour or more three times a day. Superficial heat does away with deep congestion and hence relieves pain. Koback (No. 56) The superficial heat is preferred in acute cases.

Diathermy is an effective means in the treatment where deep heat is indicated and according to Koback (No. 56) it is in the chronic case. This requires a special electrical apparatus and the application of two electrodes between which heat is generated while the electrodes and skin remain cool. In some locations of the body it is very difficult to estimate the amount of heat present. In most locations the heat is sensed by nerves, but in some locations as the articular surfaces of joints we have no sensation. In addition to this there is no circulation to act as an adjuster of heat present. The cartilage of joints under such circumstances according to Pemberton and Osgood (No. 46) if once destroyed have little or no power to regenerate. Pemberton and Osgood (No. 46) state that, "This method of treatment has a very definite place, but presumes an intimate acquaintance with both varying resistance of body tissues and with the technical application of this modality."

Indications for use of heat--A mild sense of pain immediately following the administration of heat is to be expected. Only about ten percent of the cases according to Pemberton and Osgood (No. 46) are actually made worse by heat.

The initial exposure of any joint to heat should not exceed ten minutes. One advantage exists here over massage, that is that heat can be applied directly over the affected joint and get the physiological effect while massage cannot. The type of patient suitable for systemic exposure of heat is somewhat difficult to choose. In general, however, the best results of this type of therapy have resulted in those cases in which the individuals are more robust. The emaciated anemic individual is not a good candidate for this type of therapy.

Massage--Massage must be applied in a very cautious manner as it may cause a "flare up" of the inflammatory process in the tissue and be more trouble than good. Only gentle stroking is indicated with some light kneading. This is always best in the region of the joint rather than directly over the joint. Massage in the home is best carried out after the physician has given complete instruction to some member of the family. Massage (No. 52) hastens circulation and promotes absorption. It acts as a substitute for motion, thereby aiding lymph flow. Massage should always be preceded by heating of the tissues allowing more complete relaxation.

General massage is also an effective agency in improving circulation. If well applied, it will result in most people in a sensation of well-being and relaxation. In cases where the history reveals chronic constipation or the barium roentgenalocical study reveals a spastic colon or intestinal stasis, abdominal massage has proven to be an effective agency.

Abdominal massage should be given cautiously and the masseur should be careful not to dig his fingers in and cause increase tonicity rather than the expected relaxation. A very good discussion as to the technique of

abdominal massage is given in Pemberton and Osgood (No. 46) on medical care and orthopedic care of arthritis.

Pemberton and Osgood (No. 46) have some very definite ideas as to the value of massage when applied to the body in general. First, "Nearly all of the unassisted cases suffer sooner or later from muscular atrophy." Second, "They nearly all, sooner or later, reach a condition of inactivity in which there should be supplied some substitute for normal physiological exercise." Third, "Either because of inherent errors incidental to arthritis, the general metabolism suffers more or less disability, as is partly evidenced by the lowered basal metabolic rate observable in many cases."

The influence of massage seen locally is to increase function, decrease pain, and promote absorption of effusion. It also serves to prevent further atrophy, promotes better circulation, in the muscles and elsewhere. Its general influence aids in relaxation and increase of appetite.

Exercise is a measure that may be used along with massage and can be used to replace it during later stages of convalescence. It is important for the atrophic arthritic patient to move his joints of his own volition to prevent ankylosis. Exercise should be performed short of that point of irritation. Active exercise must be used as early as possible. Massage in no sense can completely replace exercise. Late in the stage of convalescence walking is a very useful form of exercise. As recommended by Pemberton and Osgood (No. 46) walking and hill climbing is very good. Many arthritics because of positional deformity are able to do this early. This is frequently encountered in arthritis even though it is a result of faulty early care. In estimating the amount of exercise which is beneficial for the individual patient, it is often important to pass judgment the following day, after the

given exercise rather than an hour after exercise. As stated earlier in this thesis with reference to hypertrophic type, the joints often "limber up", but are followed by a period of increased stiffness. If the exercise has resulted in a beneficial manner, the following day the patient should experience less pain. Exercise in this stage of convalescence has another value that is often overlooked, that of the psychic influence. Most patients judge their improvement on ability to perform every day activities. In many instances a patient may be well as far as his arthritis is concerned but is unable to perform tasks that he had been able to do at the onset when everything pointed to invalidism. Attempt shall now be made to discuss the local care of individual joints.

ATROPHIC ARTHRITIS, LOCAL CARE

Knee Joint--The flexed, painful, swollen, tender arthritic knee is very difficult to manage. No patient should be allowed to bear weight before the muscles are restored to normal power. If weight bearing is allowed, the ligaments which support the joint are put on undue strain. Their attachments are traumatized and usually a recurrent of symptoms and extension of inflammation into new areas will occur.

The acute knee should be put to rest, heat applied once a day, and the patient be taught to contract the quadriceps and to relax them slowly and rhythmically several times each hour during the day. These contractions must be stopped if they cause pain. The foot should be moved slowly into dorsal and plantar flexion also a few times each hour. As soon as the muscle tone has been regained, the knee might be flexed and extended passively under considerable caution. This should be performed within the limits of comfort,

beginning with limited movements and continuing every hour. The muscles of the thigh and leg may be massaged gently. Deep massage only increases the inflammation and more spasm with resultant more deformity. When the quadriceps show sufficient power to hold the leg against gravity without pain, the exercise may be performed unaided and the splint removed. The joint itself may now be massaged and any exercise causing discomfort should be discontinued.

Active motions are now aided with an assistant. The thigh may be flexed and leg flexed on the thigh, and then complete extension. The attendant can support the leg to prevent any loss of control and to prevent pain. As soon as the knees are nearly straight and the thigh muscles are able to resist considerable gravity, the patient is ready to walk but with aid of crutches. Crutches are not discarded until a "flare up" is absolutely out of the question and then weight bearing may be started.

ANKLE JOINT

Eversion of the foot and plantar flexion are the common deformities. Massage and baking are necessary. Exercise in dorsal flexion and gentle stretching in adduction is essential to relieve strong spasm of the peroneal muscles. Metatarsal Phalangeal Articulation--Arthritis here is quite common, and the middle joints are more often affected. The proximal phalanges are hyperextended, allowing the heads to fall which causes considerable pain. The physiotherapist in this case pushes by slow and gentle pressure on the phalanges, at the same time pressing gently upward on the heads of the metacarpal bone. The patient assists actively in these motions.

HIP JOINT

Flexion and adduction are the common position of deformity. The

treatment consists in putting the hip to rest in a Thomas knee joint splint and traction. The splint should be arranged so that slight movements can be carried on without discomfort. Baking and massage are started early. As soon as the spasm subsides, movement may be allowed first in abduction, later extension and flexion, and finally rotation. Active muscle exercises are now begun, paying particular attention to abductors, extensors of the hip, and extensors of the knee joint. As soon as the tone of these muscles has improved, the patient may try active motion with some assistance from the attendant. If improvement occurs and there is no spasm, the patient may be allowed up on crutches, continuing all exercises, baking and massage until the joint is comfortable and strong enough to permit gradual weight bearing.

FINGERS

The deformities to have in mind are flexion of the phalanges, ulnar deviation, and subluxation of the metacarpal phalangeal joint. There may be hyperextension at the first metacarpal phalangeal joint. The small hyperextended joints should be kept slightly flexed. The flexed ulnar deviated fingers should be protected in a splint jointed at the wrist so that the fingers can be supported in as much extension and abduction as possible without causing too much pain. The splint must be malleable enough so that the extension can be increased from time to time. It is necessary at the same time to reduce the subluxation of the metacarpal phalangeal joint. This can be done by traction in the direction of the deformity and pressure on the head of the bone. Exercise must be prescribed to increase the power of the adductors and interossei.

WRIST JOINT

In arthritis of this joint the motion is restricted and it is often flexed and adducted. The joint is splinted in a malleable splint, so that dorsal flexion can gradually be increased. The splint must be removed several times a day for exercise as soon as the acuteness of the inflammation has subsided. Later baking, massage and gentle manipulation is indicated, followed by active motion, first in dorsiflexion, adduction, abduction, and last of all palmar flexion.

The acutely inflamed elbow must be put to rest in a comfortable position on a pillow. Care must be taken to protect the elbow from pressure, and irritation to the skin. After the acuteness has subsided gentle exercises are advocated, first in the form of contracting and relaxing both flexors and extensors without motion. Flexion and extension of the wrist and fingers aids in increasing the tone of the muscles. The above shall be followed by active motion aided by passive motion until pain has subsided enough that help is not needed.

SHOULDER JOINT

The chief deformity in this joint is adduction and internal rotation. Atrophy is most pronounced in the deltoid muscle. In the acute inflamed shoulder joint it is best to put it to rest in as much abduction as can be obtained without inducing more muscle spasm. The patient is taught how to contract the deltoid muscle without moving the joint, soon to be followed by active and passive motion. This motion is to be followed by flexion and extension. The rotary motions are left for last as they are more painful.

SPINE, CERVICAL SPINE

Deformity here often shows up by increased lordosis, and restric-

tion of movements laterally. In severe cases rest may be indicated and a Thomas collar decrease muscle spasm. Baking and light massage are helpful. Ober (No. 48) advocates neck stretching for relief of muscular spasm. This is done by the physiotherapist placing one hand on the occiput and the other hand on the chin and gentle traction is applied without rotation or any deviation. This is done several times. If this neck stretching relieves the muscle spasm, it may be followed by flexion, rotation, and lateral bending may be instituted.

DORSAL SPINE

The patient in this case is put to bed in recumbency with as much hyperextension as possible. It must be gradually increased. Deep breathing exercises are given early to increase rib movements and chest expansion.

LUMBAR SPINE

In the presence of severe pain and muscle spasm, rest is indicated. After the acuteness has subsided the patient is taught to contract the gluteal and abdominal muscles as they are important in the maintenance of posture in lumbar region. Exercise of the back muscles is aided by head lifting and thigh elevation when in prone or supine position.

The local care in hypertrophic arthritis will be handled as the treatment pertains to the joint in general. In this condition the joint is very mobile within certain degrees and very limited in other degrees causing the characteristic symptom of pain, which is mainly due to mechanical obstruction. Increase of motion causes more pain. Trauma from mechanical obstruction finally causes an increase in synovial fluid. Such joints must be kept quiet until the inflammatory process subsides. After

this has occurred, physiotherapeutic measures should be instituted. Heat and mild massage are used to stimulate circulation, then exercise to restore the muscles controlling the movements. As soon as the muscles gain back some of their tone, the joints are stretched normally until just short of pain. No weight bearing is allowed until the range of motion is sufficient to allow the patient to walk without pain. Here the main object to be kept in mind is to increase motion without increasing the size of the bony spur. In hypertrophic arthritis the joints do not ankylose except in the spine and hip joint where the chondro-osseous fringes impinge on the adjacent surface and finally fuses on to it. Fibrous or bony fusion need not be feared even if completely immobilized. (No. 11) The spicules and ridges of bone are capped with a sensitive cartilage which proliferates from frictional motion. Protect the spicule, limit the motion, or even temporarily completely deprive the joint of motion and the irritation will subside. After immobilization has been carried out, there are no changes demonstrated in the roentogram, but the patient will not complain of any symptoms whatever. If the patient is willing to limit his activities to non-irritating movements, his joint trouble may cause very little trouble later.

During the acute stage of the disease, if muscle spasm is present, effort should be made to prevent deformity. Apparatus should be light, and should not restrict the use of physiotherapy nor cause any pressure. Fischer (No. 45) advises the use of splints made from aluminum which give good exposure and also are light in weight. If plaster of paris is used for fixation, it must be applied cautiously. Unless applied correctly bone and muscle atrophy may occur early. Where there is marked spasm of

muscles some sort of traction must be applied. In the application of any apparatus for fixation, the position of the joints is of prime importance. One must always have in mind the possibility of ankylosis occurring. In case ankylosis does occur, the joint should be stiff in a position that will be optimum for future use. The problem of occupation enters in here. For example, a man earning his living as a laborer would get more satisfaction in having his knee joint ankylosed within ten degrees of complete extension, while the man earning his living doing office work would be more comfortable with a knee in far less extension. Fischer (No. 45) has given the positions that joints should be immobilized in, in order to allow for better position in case ankylosis ensues.

TABLE OF CHARACTERISTIC TYPES OF DEFORMITY with a position of election in cases of ankylosis.

Hand--Deformity: Ulnar deflection of fingers at metacarpal, phalangeal joint. Well marked flexion at the interphalangeal joints, sometimes hyperextension of interphalangeal joints. Position of Election: Moderate degree of flexion at metacarpal-phalangeal joints, absence of lateral deviation.

Wrist--Deformity: Flexion deformity. Position of election: Extension through forty-five degrees.

Elbow Joint--Deformity: Usually midway between flexion and extension, forearm in pronation. Election: Depends upon the individual's occupation and wishes of patient. Probably at ninety degrees or slightly less is best. Forearm midway between pronation and supination.

Shoulder--Deformity: Flexed, adducted, and rotated inwards. Election: Slight flexion, abduction, through forty-five degrees in adults,

seventy degrees in children.

Foot--Deformity: Hallicus valgus or rigidus, toes deviated outward at metatarso phalangeal joint with consequent flat foot. Election: Normal position, slight inversion is at times advantageous.

Ankle Joint--Deformity: Plantar flexion. Election: Foot forms an angle of ninety degrees with leg. A few degrees of dorsi-flexion is sometimes preferable.

Knee--Deformity: Flexion, in severe cases tibia is subluxated posterior and rotated inward. Election: Complete extension, if ankylosis bony, ten degrees to twenty-five degrees flexion is best.

Hip--Deformity: Flexed, adducted, and internally rotated. Election: Slight abduction, rotated outward and in extension.

SURGERY OF ARTHRITIS

The arthritic to whom this special type of surgery is applicable is the derelict. The damaged joints most often seen are those that are subjected to the atrophic type. Before a surgical attack should be thought of there are certain fundamental rules that have important bearing and must be considered. Pemberton and Osgood (No. 46) advocate the following points to be considered before the surgical attack is made: (1) Arrest or quiescence of the disease; (2) Preliminary treatment to improve the patient's general condition as much as possible; (3) Correct appraisal of the patient as an operative risk; (4) A knowledge of the patient's psychology and a belief in his ability to maintain his morale; (5) An accurate estimate of the number and nature of the operations which will be required to attain the functional objective; (6) Provision for carrying through the entire operative campaign. This includes (a) special hospital facilities and optimistic, experienced nursing; (b) Consideration of the patient's financial resources in relation to after-treatment, especially physical therapy and long follow-up; (7) Thorough training in joint surgery, good judgment, and meticulous technique on the part of the surgeon.

To warrant a surgical attack on any joint there must be an objective. (No. 3) It must be born in mind that some patients with slight amount of crippling may have their ability to make a livelihood restored while others with more extensive involvement may only be enabled to enact the problems of toilet care, eating, without assistance, walking, standing up, or sitting down without assistance.

The time to operate is a big problem. One should never attack an atrophic arthritis until six months after it has become quiescent. (No. 3)

In most all cases of chronic arthritis there is a stage reached sooner or later when local symptoms around the joint subside and general nutrition improves. Although the patient still remains a cripple, activity of the disease has been arrested. The most common source of error (No. 3) is that the activity of the disease has become arrested but pain persists because of destruction within the joint and adhesions. In the hypertrophic type there really is no active stage of the disease, but acute "flare ups" may result from trauma or sprain to a badly damaged joint or deformed joint.

Indications for operation according to Frankling (No. 28) are (1) to relieve pain; (2) to correct deformity; (3) and to restore mobility.

Classification of surgical procedures available: (No. 28)

I. Non-Operative Procedures

A. Manipulation

II. Operative Procedures

A. Intra-articular

1. Arthroplasty
2. Synovectomy
3. Erosion
4. Remodeling and reconstruction
5. Excision
6. Arthrodesis
7. Arthroplasty
8. Pseudo-arthritis
9. Cheilectomy

B. Extra-Articular Procedures

Manipulation Procedures

Manipulation is a procedure described by J. Mennel (No. 35) as a "twist", by this is meant that the joint is put through movements that are not under voluntary control of the individual. This procedure is usually called on because of the fact that the joint has been allowed to become deformed, usually flexion deformity. The joint having been allowed to once assume a positional deformity, an adaptive shortening of the peri-articular structures muscles, tendons, and capsular ligaments takes place shortly. A predisposition in this tissue already exists because of the disease present. This accounts for in many cases the entire deformity as is seen early. However, in the late cases intra-articular changes may likely be present. Deformity often is not only seen in the joint with the pathologic process (No. 28) but adjacent joints may too take part in the deformity.

Another condition helped by manipulation is adhesions that may be present in and around the joint. Adhesions may complicate disease or be the sole cause of stiffness. Adhesions are defined by R. Jones (No. 37) as a "band-restricting movement between adjacent tissues due to an effusion either within or without a joint, following injury or disease." Early it is soft and yielding, later it loses its vascularity and becomes cicatricial. Extra-articular adhesions stiffen the joint by involvement of the surrounding tissues, the intra-articular adhesion stiffens the joint by its attachments to any part of the joint structures. The differential diagnosis of the presence or absence of adhesions is at times a difficult problem. A rule set down by Sir Robert Jones (No. 37) is valuable in the differential diagnosis, "A joint whose movement is limited in all directions is or has

been subject to arthritis, while a joint which is limited in certain directions only, movement being normal in others, is not arthritic." This factor is more obvious in joints of multiple motions as hip, wrist, and shoulder. He qualifies the above rule by saying, "It does not apply to septic infections involving the articular or periarticular tissues, fractures within joints, or to joints temporarily stiffened by prolonged fixation." Sir Robert Jones recommends (No. 37) that adhesions in chronic cases are often preventable by putting the joint through active motion within a degree where pain is not noticed. He recommends this to be done as soon as the painful acute stage has subsided and to be performed several times a day. If passive motion is employed, it should be done but once a day and under extreme caution for fear of a "flare up." Success is determined largely in knowing when to manipulate and when not to. Sir Robert Jones (No. 37) considered the following points in determining when to manipulate, "A joint may be considered over the disease when its degree of motion is not decreased by motion or in case of ankylosis, when its position does not alter by use."

Active motion is preferable to passive motion in arthritic joints. They are gentle, free from pain, and the muscle is exercised. Passive motion is instituted in nervous patients and children but should be done under close supervision. Passive motion should be limited in extent and never more than one motion at a time. (No. 37)

Recent adhesions may be broken down under gas oxygen anesthesia, but more firm adhesions require complete anesthesia. Direct comparison with the motions of the normal extremity can be made for a guide to the possible motion. According to Sir Robert Jones (No. 37) it is much better to break the adhesions down with one procedure unless the adhesions are too

strong. The after care is of considerable importance in order to maintain the success of the procedure. The joint should be put into active motion as soon as the procedure is through and moved passively once a day. Effusion following the procedure without any decrease in the range of motion may be disregarded. (No. 37) Pain persistent in nature is important but of short duration and is negligible. To clarify the above statement that manipulation is a "twist" (No. 35), the subject will be taken up in detail. The metacarpal phalangeal joint will be used as an example.

The most valuable movement is that of tension, whereby the joint surfaces are pulled apart. The manipulator ~~grasps~~ the finger with a hold similar to taking hold of a golf club and exerts tension with the other. In other words in the manipulative procedure of any joint the one hand is used for tension, the other for immobilizing the joint. Then with the metacarpal bone mobilized the phalanx is moved anterior and posterior on the head of the metacarpal bone. If no leverage is used the manipulator can use all the strength he can give. Next in order is to stretch the lateral ligaments. This is done by a similar movement laterally but not by that of abduction and adduction.

Rotation is the next step. This is done by flexion of the distal phalanx which gives a hook whereby leverage can be obtained. Do not exert full force as undue force may result in much harm.

Finally the movements under voluntary control are reached, that of flexion, extension, adduction, and abduction. The metacarpal phalangeal joint is a sliding joint rather than a hinge joint. In order to force flexion without doing harm to the joint, the phalanx must glide around the head of the metacarpal bone. In order to force flexion the metacarpal bone

is fixed and the thumb presses on the head of the phalanx pushing it down and hence glides it around the articular surface. All this consideration must be given to each joint in the body in order to prevent undue damage on the parts concerned.

EXTRA-ARTICULAR OPERATIVE PROCEDURES

Under this heading is included the division of peri-articular structures such as tendons, capsule, and fascia, which cause deformity and prevent carrying out of one or more movements normal to the joint. These may be divided subcutaneously or by open operation. Most of these procedures are simple except the posterior ligament of the knee joint which needs a deep and somewhat troublesome exposure for its dissection.

Where manipulative procedures fail to succeed as corrective measures, the operation of posterior capsuloplasty in the knee, described by P. D. Wilson (No. 46), is indicated.

The cases in which extra-articular open operation is likely to be sufficient can, as a rule, be determined with very little difficulty. They will include in general those with minor degrees of deformity and little intra-articular change as shown by Xray or determined clinically. A full trial should be considered before open intra-articular procedures are attempted.

INTRA-ARTICULAR OPERATIVE PROCEDURES

Synovectomy--The earliest reference to such an operation was by H. Tubby in 1908 (No. 26). At that time he referred to the results of such an operation when the hypertrophied villi, thickened synovial membranes, synovial pads, fluid, and other products of disease were removed, as having the effect of lessening the virulence of the disease elsewhere in the body and producing not only improvement in the local joint but also others.

Tubby (No. 26) also states that the products of the pathological process of arthritis often remain tender for a long time and that their removal often gives gratifying results in relieving symptoms.

As Osgood (No. 46) states this operation is chiefly applicable to knee joints of the atrophic type of arthritis. Ellis Jones (No. 25) holds that pyogenic arthritis and acute atrophic type of arthritis are definite contra-indications for synovectomy. It is indicated in his opinion for (1) a definite type of low grade infection in which after months or even years the pathologic lesion still remains in the knee joint. It is characterized by bone exudate in form of osteophytes, synovial hypertrophy, various degrees of atrophy, hypertrophy of suprapatellar fat pad, and degeneration of semilunar cartilages; (2) lipoma aborescens or villous arthritis; (3) osteo-chondromatosis. He uses a tourniquet, operates without hand contact, avoids splinting, and insists the joint be moved voluntarily in twenty-four hours.

Swett (No. 13) in his paper on this operation takes in to consideration three factors. First, before considering the operation all surgical foci of infection must have been removed. The health of the patient must indicate that activity in the local lesion must have subsided, and it must be known that the removal of the exudate left by previous disease will restore function. Second, in addition to the mechanical aid in removing such exudate, the exudate, even though not demonstrating any activity might act as a possible foci for further uninvolved joints. The third factor taken into consideration has reference to Pemberton (No. 13), his idea of lowered metabolism in arthritis joints.

His conclusions are that if the exudate were removed from a joint inactive because of the presence of a mechanical interference and the joint allowed to restore its function that there would then be some stimulant to local metabolism. Steindler (No. 15) mentions in his paper the fact that in the removal of all the diseased tissue in and around a joint that it should be no less potent in the irradiation of the focus of infection, than the removal of some foci in some other remote location. The indications for synovectomy by Steindler are much the same as those listed above by Jones (No. 25). With Swett (No. 13) he believes the results from synovectomy are beneficial not only from a mechanical standpoint but from a standpoint of foci of infection as well.

The beneficial results as described by Osgood (No. 46) are mechanical only by the removal almost en masse of the permanently proliferated synovial membrane which is characterized by long standing atrophic arthritis. A regeneration of the synovium may be expected as this synovial membrane not like the articular cartilage does have powers of regeneration.

REMODELING AND RECONSTRUCTION OPERATIONS

Such an operation consists in gaining access to the joint cavity and the removal of diseased joint structures as hypertrophied villi and osteochondromatosis. In other words it is an extended operation from the simple synovectomy. According to Osgood (No. 46) the purpose of such an operation is, "To regain motion, assure stability, and relieve pain," and are chiefly applicable to the hip and knee joint. In the latter joint it consists mostly in the removal of painful chondro-osseous spurs which are associated with hypertrophic type of arthritis. This same simple procedure advocated for the hip joint has been called chielectomy. (Osgood No. 46) Further details of such procedure in the hip may be found in Royal Whitman's paper. (No. 12)

EXCISION

Frankling (No. 28) states this to be the oldest surgical procedure advocated in the treatment of arthritis. It consists in resection of the whole articular surface, no attempt being made to reconstruct the joint. The primary aim in the operation consists in relief of pain, by the removal of diseased joint surface. Frankling (No. 28) expects as a functional result in the hip, elbow, wrist, a pseudiarthrosis, while in the knee he expects arthrodesis. The set operation has always been of limited value in arthritis and has been largely by arthroplasty and arthrodesis.

ARTHRODESIS

This operation consists of the removal of those structures of the joint that are for mobility, producing an ankylosis in the optimum position for the joint concerned. The purpose of this operation as stated by Osgood (No. 46) is, "To totally deprive a joint of motion with the object of affording complete stability or of relieving the frequent painful strains associated with small and functionally useless arcs of motion." Max Page (No. 29) in discussing the practice of arthrodesis on large joints regards it as the most radical and final procedure of the treatment of arthritis. It cannot be considered ideal because ~~the~~ the function of the joint is eliminated. It may relieve all pain in the affected joint but may cause unusual strains on neighboring joints and cause secondary changes in them. McBride (No. 4) advocates arthrodesis to be useful in cases where destructive lesions are of such ~~mature~~ nature that restriction of motion would relieve pains and promote cure, where as synovectomy or an arthroplasty would aggravate the disease and result in failure. He also advocates the procedure in alleviating pain in joints that are not anatomically situated favorable to arthroplasty such as the spinal joints.

Arthrodesis is rarely indicated in the atrophic type of disease as the condition itself precedes the surgeon in most instances in producing an ankylosis. There are, however, according to Osgood (No. 46) many incomplete bony ankylosis as a result of atrophic arthritis that need further attention of the surgeon. As for example, the mid tarsal joints. Arthrodesis on the tarsus in mid region causes a very small amount of functional disability while the small amount of "give" which is allowed before complete fixation is enough to cause walking to be very painful. Osgood (No. 46) claims that arthrodesis is most applicable to hypertrophic arthritis of the hip, that type frequently termed morbus coxae senilis. This condition causes destruction of the articular surface and motion is limited by chondro-osseous, marginal spurs impinging on each other. This rarely ever results in ankylosis without intervention.

ARTHROPLASTY

Frankling (No. 28) defines arthroplasty "as operative mobilization of a stiff joint." Until quite recently arthroplastic operations have been considered to have little place in the reconstruction surgery of chronic arthritis. It has been considered in the past that many of these patients are poor operative risks, morale low, and the musculature involved was so inferior that it seemed hopeless to obtain good results. On the contrary as Osgood (No. 46) states, "their morale is high, and they are not poor risks," and by patient, preoperative exercises and massage their muscles may be sufficiently "toned up" to accept the responsibility of early voluntary activation of joint movements.

The selection of such cases to be subjected to such an operation must be left to the judgment of someone well experienced in this line of operative surgery.

With the exception of the hip joint, hypertrophic arthritic patients are not helped a great deal. Selection should be made from that group of atrophic arthritis where the activity of joint lesion has subsided and patients who have been left with a fair state of general health and who will respond to the proper preoperative care. In subdividing this group even farther Osgood (No. 46) has obtained best results in patients of the atrophic type who have responded to treatment where bacterial foci have seemingly been the etiological factor. In his experience it has been in this group that early ankylosis has occurred yet leaving the surrounding musculature in good state of preservation.

The jaw, elbow, knee, and hip in order named seem to be the most suitable for arthroplasty. (No. 32.) Some success has been reported by Henderson (No. 32) on the shoulder but at the same time movements of the shoulder are so often compensated for by the scapula and therefore make it indicated in less cases.

Cooperation of the patient is extremely important. The patient must be enthusiastic about attempting to produce motion in the joint and he must have staying qualities to carry through the after treatment of the operation. Children are, as a rule, poor subjects for this operation as they so often lack the appreciation of proper after care of the joint.

If the ankylosed joint is in suitable position for ordinary uses and does not interfere seriously with the patient's occupation, surgery of this kind must be seriously considered and the possibilities of limitations must be put before the patient. The occupational and economical status must be carefully considered with every case. If the joint is ankylosed in a position that seriously hampers the patient in his occupation, the operation may be more readily urged.

Some difference of opinion has existed on the question of the surgical and anatomical conditions which justify the performance of an arthroplasty. The opinion of Mac Ausland (No. 32) has been accepted by many. He says, "(1) Two stiff hips will indicate arthroplasty on one hip, possibly both; (2) two stiff elbows will indicate the same; (3) two stiff knees will present a definite indication for an arthroplasty on one knee at least; (4) combination of hips and knees in one individual, a condition not frequently seen, is a very definite indication for attemptin to immobilize one or more joints."

The procedure for arthroplasty is subject to many complications. As Albee (No. 4) states, "In the post-operative care, if the joint is immobilized for too long a time, the joint is apt to become re-ankylosed by fibrous tissue or bony formation. If the joint is moved too soon, the healing structure may bleed so profusely as to cause a hematoma in the new joint or surrounding joint structures with the array of difficulties which that entails." The tendency for development of the arthritic process in the newly formed joint is considerable, the poor quality of bone, the muscular atrophy, the general deterioration, both physical and mental, all are problems that make this operation less favorable.

CHEILECTOMY

This is the operation pertaining to the removal of osteophytic lips which surround a joint. It is advocated chiefly for osteoarthritis of the hip. It is said by Jones and Lovett (No. 62) to be "successful in those cases in which the osteophyte is purely local and limits some motion." Graves (No. 63) has had the experience similar to Jones and Lovett. According to him in most instances this operation is only of temporary benefit because the real

trouble has not been touched, that of inside the joint. In osteoarthritic processes involving the hip joint Graves (No. 63) modifies the simple chielectomy procedure by adding to the removal of the osteophytes a plastic procedure where he dislocates the head of the femur and removes a portion of the head so that the head loosely fits in to the acetabulum. He claims this gives permanent benefit over the temporary relief seen in the more simple procedure.

CONCLUSION

1. The prevalence of the two types of arthritis, atrophic and hypertrophic in the herbivorous and carnivorous type of individual is of considerable clinical importance from a prophylactic standpoint.
2. The care of faulty posture and body mechanics is important both from a preventive measure as well as a therapeutic principle.
3. Adequate traction and fixation properly applied are cardinal points in the local care of arthritic joint and do much to relieve pain, prevent deformity, and maintain a moveable joint.
4. Physiotherapeutic agencies intelligently used relieve symptoms and promote resorption of the pathological process.
5. Optimum position for fixation is important because of the possibility of future ankylosis.
6. Surgery of arthritis is applicable to the derelict.
7. Before a patient is subjected to surgery exhaustive study should be made in to the local pathological condition, present, general, physical, and mental make-up, financial and occupational status.
8. Hospital facilities and experienced nursing are important factors as well as good judgment and technique on the part of the surgeon.

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